the film first formed, and the greater part of the fluid trickling from above, being carried to the lower extremity, of the stalactite already formed, its prolongation downward in a vertical direction, is easily understood.

To the completion of this theory it would obviously be necessary to explain—1st. Why the stalactite, while small, does not become sealed up at the vertex; and 2dly. Why, when its bulk is augmented, its internal cavity is obliterated.

The reason why the drop with which the formation of a stalactite commences does not become covered with a coating of spar at its lowermost point, appears to me to be, that the hydrostatic pressure of the solution which is constantly flowing down from above, and dropping on the floor of the cave, removes it mechanically as fast as it is produced. The other fact is still more easy of comprehension. The fluid which fills the fistulous cavity of a small stalactite, as well as that which trickles down its external surface, gradually lets fall particles of spar; the deposition, however, in the former case, being much more slow, owing to the obstacle presented by the sparry envelope to evaporation. A real and progressive growth of the internal surface, does nevertheless take place, in virtue of which the diameter of the fistulous opening constantly diminishes, and the cavity itself finally disappears.

Before closing this paper, I should not omit to mention that no bones, either of existing or extinct animals, have as yet been found within the cavern; nor indeed is it likely that any such will be discovered; as, until accidentally perforated through the quarry, it would appear to have been altogether impervious, and therefore inaccessible as a den or place of shelter to those kinds of animals whose osseous remains have been found in such abundance in the cave of Kirkdale, and elsewhere.

CURIOUS ARITHMETICAL CALCULATIONS.

RECREATIONS IN MATHEMATICS AND NATURAL PHILOSOPHY:

CONTAINING AMUSING DISSERTATIONS AND ENQUIRIES CONCERNING A VARIETY OF SUBJECTS CALCULATED TO EXCITE CURIOSITY AND ATTENTION.

The following are answers to the four queries proposed in our last number:

I. It is evident that, to pick up the first stone, and put it into the basket, the person must walk 2 yards, one in going and another in returning; that for the second he must walk 4 yards; and so on, increasing by two as far as the hundredth, which will oblige him to walk two hundred yards, one hundred in going, and one hundred in returning. It may easily be perceived also, that these numbers form an arithmetical progression, in which the number of terms is 100, the first term 2, and the last 200. The sum total, therefore, will be the product of 202 by 50, or 10100 yards, which amount to more than five miles and a half.

II. This question may be easily answered, by the rules already given; for the difference of the terms is 2, and the number of terms 20; consequently, to find the twentieth term, we must multiply 2 by 19, and add 58, the product, to the first term 3, which will give 41 for the twentieth term.

If we then add the first and last terms, that is 3 and 41, which will make 44, and multiply this sum by 10, or half the number of terms, the product 440 will be the sum of all the terms of the progression, or the number of shillings due to the bricklayer when he had completed the work. He would therefore have to receive twenty-two pounds.

III. Those who might imagine that two-fifths of the whole sum were due to the workman, because eight yards are two-fifths of the depth agreed on, would certainly be mistaken; for it may be easily seen that, in cases of this kind, the labour increases in proportion to the depth. We shall here suppose, for it would be difficult to determine it with any accuracy, that the labour increases arithmetically as the depth; consequently the price ought to increase in the same manner.

To determine this problem, therefore, 20*l.* or 400 shillings must be divided into 20 terms in arithmetical progression, and the sum of the first eight of these will be what was due to the bricklayer for his labour.

But 400 shillings may be divided into twenty terms, in arithmetical proportion, a great many different ways, according to the value of the first term, which is here undetermined; if we suppose it, for example, to be one shilling, the progression will be 1, 3, 5, 7, &c., the last term of which will be 39; and consequently the sum of the first eight terms will be 64 shillings. On the other hand, if we suppose the first term to be $10\frac{1}{2}$, the series of terms will be $10\frac{1}{2}$, $11\frac{1}{2}$, $12\frac{1}{2}$, $13\frac{1}{2}$ $14\frac{1}{2}$, which will give 112 shillings for the sum of the first eight terms.

But, to resolve the problem in a proper manner, so as to give to the bricklayer his just due for the commencement of the work, we must determine what is the fair value of a yard of work, similar to the first, and then assume that value as the first term of the progression. We shall here suppose that this value is 5 shillings; and in that case the required progression will be $5, 6\frac{1}{19}, 8\frac{3}{19}, 9\frac{14}{19}, 11\frac{6}{19}$ $12\frac{7}{19}$ &c., the common difference of which is $\frac{30}{19}$, and the last term 35. Now to find the eighth term, which is necessary before we can find the sum of the first eight terms, multiply the common difference $\frac{30}{19}$ by 7, which will give $11\frac{1}{19}$, and add this product to 5 the first term, which will give the eighth term $16\frac{1}{19}$; if we then add $16\frac{1}{19}$ to the first term, and multiply the sum, $21\frac{1}{19}$, by 4, the product, $84\frac{4}{19}$, will be the sum of the first eight terms, or what was due to the bricklayer, for the part of the work he had completed. The bricklayer therefore had to receive $84\frac{4}{19}$ shillings or 4*l.* 4*s.* $2\frac{10}{19}$*d.*

IV. In this problem the payments to be made each month ought to increase in arithmetical progression. We have given the sum of the terms, which is equal to the sum total of the debt, and also the number of these terms, which is 12; but their common difference is unknown, because it is that by which the payments ought to increase each month.

To find this difference, we must take the first payment multiplied by the number of terms, that is to say, 1200 pounds, from the sum total, and the remainder will be 660, we must then multiply the number of terms less unity, or 11, by half the number of terms, or 6, and we shall have 66; by which if the remainder 660 be divided, the quotient 10 will be the difference required. The first payment therefore being 100, the second payment must have been 110, the third 120, and the last 210.

QUERIES IN GEOMETRICAL PROGRESSIONS.

A courtier having performed some very important service to his sovereign, the latter, wishing to confer on him a suitable reward, desired him to ask whatever he thought proper, promising that it should be granted. The courtier, who was well acquainted with the science of numbers, only requested that the monarch would give him a quantity of wheat equal to that which would arise from one grain doubled sixty-three times successively. What was the value of the reward?

A gentleman taking a fancy to a horse, which a horse-dealer wished to dispose of at as high a price as he could, the latter, to induce the gentleman to become a purchaser, offered to let him have the horse for the value of the twenty-fourth nail in his shoes, reckoning one farthing for the first nail, two for the second, four for the third, and so on to the twenty-fourth. The gentleman, thinking he should have a good bargain, accepted the offer: what was the price of the horse?

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